



# First record of *Thamnodynastes almae* Franco & Ferreira, 2002 (Serpentes, Dipsadidae, Xenodontinae) in the state of Piauí, northeastern Brazil, and updated distribution map

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## Abstract

We report for the first time the snake *Thamnodynastes almae* Franco & Ferreira, 2002 in Piauí, northeastern Brazil. Our record is based on two specimens and comprises the 17th known locality for the species. The new record represents the northernmost and westernmost locality, at the limit between the Caatinga and the Maranhão Babaçu Forest ecoregions, and extends this species' geographic distribution 495 km from Milagres, state of Ceará. Updated distribution maps and images of preserved specimens are provided.

## Keywords

Caatinga, Maranhão Babaçu Forest, range extension, South America, Tachymenini.

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## Introduction

The tribe Tachymenini Bailey, 1966 is a monophyletic group that contains seven genera of Neotropical dipsadid snakes: *Calamodontophis* Amaral, 1967; *Gomesophis* Hoge & Mertens, 1959; *Pseudotomodon* Leybold, 1873; *Ptychophis* Gomes, 1925; *Tachymenis* Wiegmann, 1835; *Thamnodynastes* Wagler, 1830, and *Tomodon* Duméril & Bibron, 1853 (Vidal et al. 2010; Grazziotin et al. 2012). The monophyly of the tribe is supported by both morphological and molecular evidence (Ferrarezzi 1994; Vidal et al. 2010; Grazziotin et al. 2012). Approximately 35 species are distributed in cis-Andean South America (Franco et al. 2003; Bailey et al. 2005, 2017; Guedes 2010; Guedes et al. 2014a, 2018).

The genus *Thamnodynastes* is the most speciose of the tribe, with 20 species distributed from 11.0166°S, 074.6833°W in Colombia to 037.4810°S, 057.5290°W in Argentina (Guedes et al. 2018; Rojas-Morales et al. 2020). Brazil harbors the greatest diversity of the genus, with 12 species (Costa and Bérnuls 2018). The genus contains species of medium size, with two enlarged grooved rear teeth, vertical pupils, a single nasal scale, and two anterior temporal scales in most species, dorsal scales in odd number of rows showing reduction in the number towards the tail, dorsal scales smooth in most species, vertebral row of the same size as neighboring scales, apical pits present, anal plate divided, distinct color pattern

composed of a blotched dorsal pattern variegated or striped posteriorly, ventral region presenting two to six longitudinal lines, and a dark postocular stripe (Peters and Orejas-Miranda 1970; Franco et al. 2017). The taxonomy of the genus is intricate, with the validity of some taxa still unsolved (e.g., *Thamnodynastes* cf. *nattereri*), and possibly with several species undescribed, despite the recent description of new species (e.g. *Thamnodynastes phoenix* Franco, Trevine, Montingelli & Zaher, 2017) (Franco and Ferreira 2002; Franco et al. 2003, 2017; Bailey et al. 2005; Bailey and Thomas 2007; Rojas-Morales et al. 2020).

*Thamnodynastes almae* Franco & Ferreira, 2002 was described based on three specimens, all from the Luiz Gonzaga Hydroelectric Plant, Rodelas, Bahia, northeastern Brazil. The occurrence of the species in Milagres, Ceará, Brazil, outside the type locality, was reported seven years later (Roberto et al. 2009). Guedes (2010) reported the occurrence of the species in five localities of four states. Currently, the species is known to occur in 16 localities in the states of Alagoas, Bahia, Ceará, Paraíba, Pernambuco, and Rio Grande do Norte (Roberto et al. 2009; Guedes 2010; Coelho et al. 2013; Guedes et al. 2014a, 2018; Freitas et al. 2019). Based on its known distribution, *T. almae* is considered endemic to the Caatinga, mostly associated with low elevation areas (below 400 m above the sea level) with xerophytic vegetation, rocky soils, and inselbergs (Guedes et al. 2014a; Dinerstein et al. 2017).

Here, we provide an updated database of the distributional records of *T. almae* and provide the northernmost and westernmost record of the species in Brazil, the first in the state of Piauí, at the border between Caatinga and Maranhão Babaçu Forest ecoregions. We also present an updated map of the species' distribution.

**Table 1.** Literature and herpetological collection data of occurrences of *Thamnodynastes almae* in Brazil. Acronyms: Coleção Herpetológica da Universidade Federal do Rio Grande do Norte (CHBEZ), Instituto Butantan (IBSP), Coleção de Herpetologia do Museu de Fauna da Caatinga (MFCH), Museu de Zoologia da Universidade Federal da Bahia (MZUFBA), Museu de Zoologia da Universidade de São Paulo (MZUSP), Coleção Herpetológica da Universidade Federal da Paraíba (CHUFPB).

| State               | Locality  | Latitude (°S) | Longitude (°W) | Voucher                              | Reference                               |
|---------------------|---|---------------|----------------|--------------------------------------|---|
| Piauí               | Nazareth Eco Resort, municipality of José de Freitas        | 04.7993       | 042.6136       | CHNUFPI(SER)0116, 0117               | This study                              |
| Alagoas             | Hydroelectric Plant Xingó, municipality of Piranhas         | 09.6167       | 037.7833       | MZUFBA 847                           | Guedes 2010                             |
| Bahia               | Hydroelectric Plant Luiz Gonzaga, municipality of Rodelas   | 09.1000       | 038.3333       | IBSP 52134-52136                     | Franco and Ferreira 2002                |
| Bahia               | Hydroelectric Plant Itaparica, municipality of Paulo Afonso | 09.4000       | 038.2000       | MZUFBA 131-38                        | Guedes 2010                             |
| Bahia               | Municipality of Itiúba                                      | 10.7297       | 039.8454       | MZUSP 5433-34                        | Guedes 2010                             |
| Ceará               | Municipality of Milagres                                    | 07.2781       | 038.9363       | IBSP 76969                           | Roberto et al. 2009                     |
| Ceará               | Mocambo Farm, municipality of Picuí                         | 06.5052       | 036.3368       | CHUFC 1672                           | Guedes et al. 2014                      |
| Paraíba             | Bravo Farm, municipality of Cabaceiras                      | 07.2755       | 036.2214       | UFPB 4263                            | Guedes 2010                             |
| Paraíba             | Municipality of São José de Piranhas                        | 07.1100       | 038.4900       | MFCH 1870                            | Coelho et al. 2013                      |
| Pernambuco          | Municipality of Petrolândia                                 | 08.8980       | 038.3043       | IBSP 52119                           | Guedes 2010                             |
| Pernambuco          | Municipality of Cabrobó                                     | 08.5000       | 039.3100       | MFCH 1847, 1862                      | Coelho et al. 2013                      |
| Pernambuco          | Municipality of Salgueiro                                   | 08.0700       | 039.1200       | MFCH 1867                            | Coelho et al. 2013                      |
| Pernambuco          | Municipality of Floresta                                    | 08.5900       | 038.5700       | MFCH 1849-52, 1855-61, 1865, 1868-69 | Coelho et al. 2013                      |
| Pernambuco          | Municipality of Custódia                                    | 08.0800       | 037.6400       | MFCH 1848, 1863-64                   | Coelho et al. 2013                      |
| Pernambuco          | Municipality of Sertânia                                    | 08.0756       | 037.2693       | MFCH 1853-54, 1866                   | Coelho et al. 2013; Freitas et al. 2019 |
| Pernambuco          | Municipality of Arcos                                       | 08.4184       | 037.0585       | not informed                         | Freitas et al. 2019                     |
| Rio Grande do Norte | Tanques Farm, municipality of Santa Maria                   | 05.8540       | 035.7010       | CHBEZ 3044-3046                      | Jorge and Freire, 2011                  |

## Methods

We examined specimens of the genus *Thamnodynastes* housed in the Coleção de História Natural da Universidade Federal do Piauí (CHNUFPI), Campus Amílcar Ferreira Sobral, Floriano, Piauí, Brazil. We carefully examined the specimens based on the following external morphological characters: body and head color pattern; measurements of the body, head and tail; meristic characters (Franco and Ferreira 2002; Franco et al. 2003, 2017; Bailey et al. 2005; Bailey and Thomas 2007). We measured the snout vent length (SVL), tail length (TL), and total length (TotL) using a measuring tape; the relative TL was obtained by dividing TL by TotL. Scale counts followed Dowling (1951). We determined the sex with a ventral incision at the base of the tail.

We reviewed the scientific literature for occurrence records of the species in South America (Table 1). Updated distribution maps were drawn using QGIS v. 2.14 (QGIS Development Team 2018).

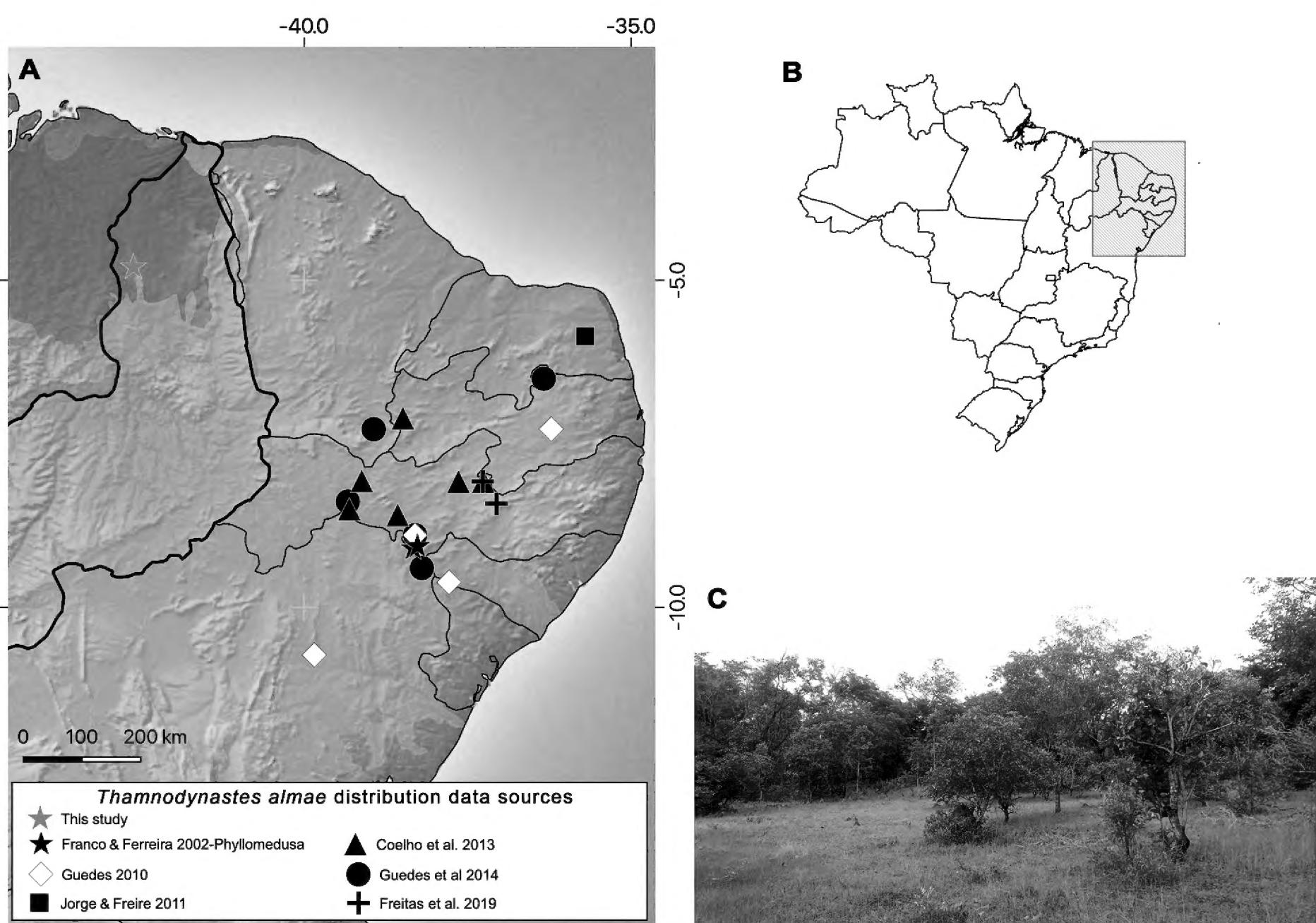
## Results

### *Thamnodynastes almae* Franco & Ferreira, 2002

Figures 1, 2

**New record.** BRAZIL • 1 ♂ adult, 412 mm SVL, 100 mm TL, 5.12 TotL/TL; state of Piauí, municipality of José de Freitas, Nazareth Ecoresort; 04.7993°S, 042.6136°W, 159 m a.s.l.; July 2007; Vitor Hugo Gomes Lacerda Cavalcante leg. (field number ERN032) [CHNUFPI(SER) 0116]. • 1 ♀ adult, 433 mm SVL, 121 mm TL, 4.57 TL/CL; same locality data, collection date, and collector as above (field number ERN049) [CHNUFPI(SER) 0117].

**Identification.** We identified both specimens [CHNUFPI(SER) 0116, 117; Fig. 2] following Franco and Ferreira et al. (2002).



**Figure 1.** **A.** Distribution of *Thamnodynastes almae* based on literature records, including the new record. White Diamond: Guedes 2010; Black square: Jorge & Freire 2011; Black Triangle: Coelho et al. 2013; Black circles: Guedes et al. 2014; Black cross: Freitas et al. 2019; Black star: Franco and Ferreira 2002 (type locality); Red star: new record in the Nazareth Ecoresort, Municipality of José de Freitas, state of Piauí, Brazil. Ecoregions classified according to Dinerstein et al. 2017 (available at <https://ecoregions2017.appspot.com>): light green area shows the boundaries of the Caatinga, brown shows the limits of the Maranhão Babaçu Forest. **B.** Northeastern region of Brazil where *T. almae* occurs. **C.** Vegetation type where *T. almae* was recorded.

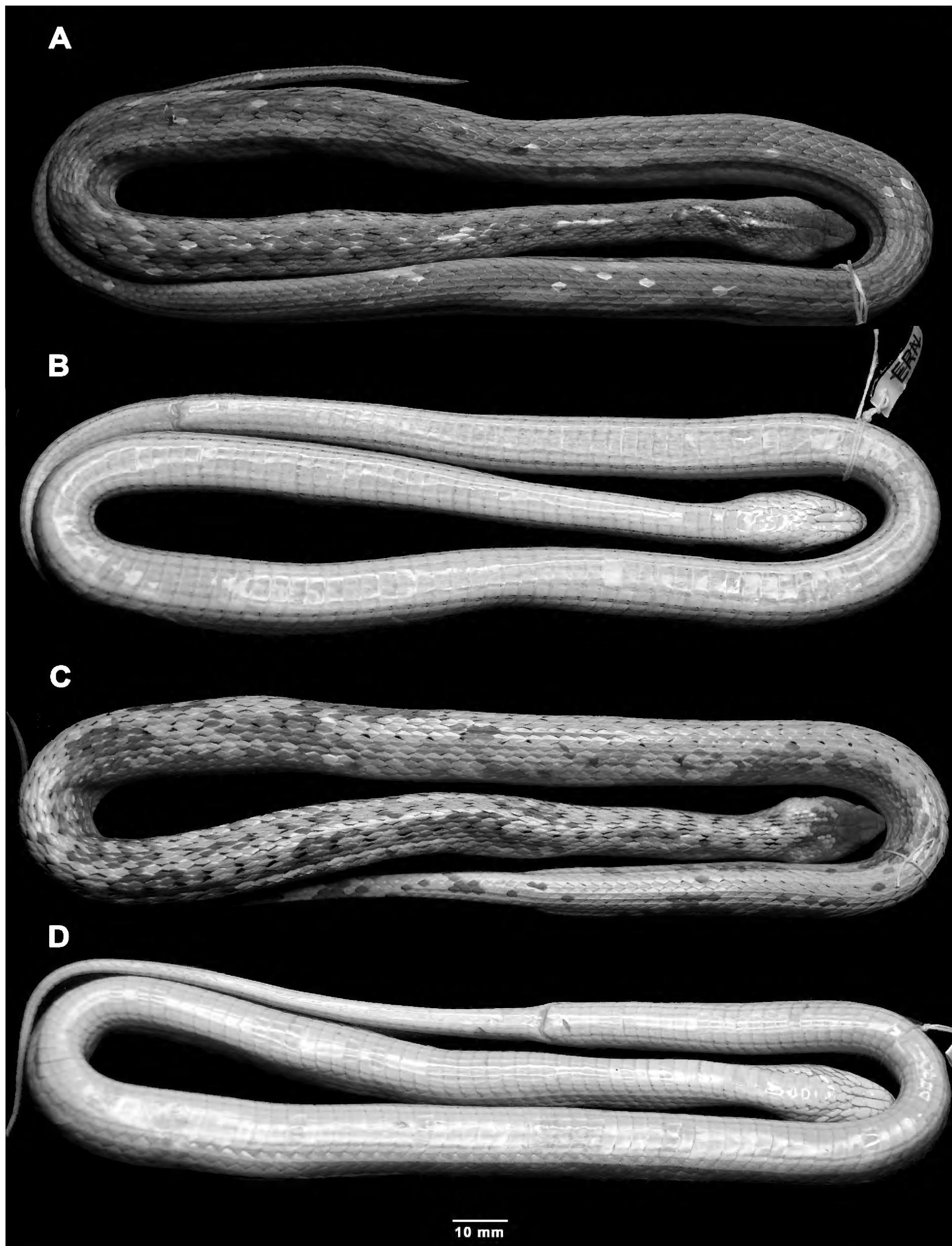
reira (2002), based on the following diagnostic characters: dorsal scales heavily keeled in 19-19-15 rows; 159 ventral scales in the male and 158 in the female; 67+1 paired subcaudals in the male and 65+1 in female; cloacal scale divided; eight supralabials on both sides of the head with the 3rd to 5th supralabials contacting the orbit; nine infralabials on both sides, 1st to 5th contacting the first pair of chin shields, 5th contacting the second pair of chin shields, temporals 2+2, one preocular and two postoculars on both sides of the head, loreal plate higher than long, maxillary tooth with trace of a groove (opystoglyphous). In 70% ethanol, the dorsal background color is light yellowish brown, the gular region is immaculate light, and the ventral region is light with a homogeneous longitudinal line that does not darken towards the cloaca. Our photographs, and pholidosis of the specimen, were also verified by Francisco L. Franco, who confirmed the identification.

## Discussion

The two specimens examined here represent the 17th known locality for *T. almae* and the first record of the species from the state of Piauí (Table 1). Both specimens were collected at the transition between the Maranhão Babaçu Forest and the Caatinga ecoregions (Dinerstein

et al. 2017; Fig. 1A, B). Specimens were collected in the Eco Resort Nazareth, which is covered with semideciduous forest, patches of Cerrado *sensu stricto*, and palm grove (Fig. 1C). This record is the northernmost and westernmost one for the species, extending its distribution 495 km from Milagres, state of Ceará (Roberto et al. 2009). Our new record also extends the estimated extent of occurrence from 90,775 km<sup>2</sup> (Guedes et al. 2014a) to 2,225,890 km<sup>2</sup>.

Despite the valuable attempts to provide data about the herpetofauna of Piauí (e.g., Rocha and Prudente 2010; Rodrigues and Prudente 2011; Silva et al. 2015; Madella-Auricchio et al. 2017; Araújo et al. 2020), systematic and long-term inventories are still needed to provide data on snake fauna. The state of Piauí can potentially harbor a high richness of snakes (and other organisms) because it spans five ecoregions (Caatinga, Cerrado, Maranhão Babaçu Forests, Northeastern Brazil Restingas, and Brazilian Atlantic Dry Forests; Dinerstein et al. 2017), which promote a mosaic of vegetation types. Additionally, the topography varies from sea level at the coast to approximately 822 m a.s.l. near the border with Ceará (Parque Nacional de Ubajara) and also at the borders with Bahia, Tocantins, and Maranhão (Nascientes do Rio Parnaíba National Park), which could harbor



**Figure 2.** Specimens of *Thamnodynastes almae* recorded in the Nazareth Ecoresort, Municipality of José de Freitas, state of Piauí, Brazil. **A, B.** Adult male CHNUFPI(SER) 0116: (A) dorsal view; (B) ventral view. **C, D.** Adult female CHNUFPI(SER) 0117: (C) dorsal view; (D) ventral view.

lowland and highland species. Sixty species of snakes are known to occur in Piauí, which is few compared to nearby states, and is the result of the relatively less sampling effort in the state (Guedes et al. 2018: fig. 2A, B).

Two snakes species were associated with the genus *Thamnodynastes* in the inventories and taxonomic studies in Piauí: *T. hypoconia* (Cope, 1860), which was reported in Parnaíba and Piracuruca (Guedes et al. 2014a),

and *T. phoenix*, reported from Castelo do Piauí, Canto do Buriti, Estação Ecológica Uruçuí-Una, Piracuruca, São Raimundo Nonato, and Valença do Piauí (Franco et al. 2017). *Thamnodynastes* sp. was also reported in the same municipalities mentioned above (Rocha and Prudente 2010; Rodrigues and Prudente 2011; Madella-Auricchio et al. 2017). This unidentified species might represent additional specimens of *T. hypoconia*, *T. phoenix*, or even *T. almae*. *Thamnodynastes sertanejo* Bailey, Thomas & Da Silva, 2005 might also occur in Piauí if extensive inventories were undertaken in the area; *T. sertanejo* occur in bush vegetation in semi-arid lowlands, which are typical of the Caatinga, and occur in the municipality of Exú, state of Pernambuco, only 91 km from the border of Piauí (Guedes et al. 2014a). *Thamnodynastes hypoconia* presents a horseshoe-shaped mark in the gular region (Franco and Ferreira 2002). *Thamnodynastes phoenix* has the gular region extremely spotted with dark-brown dots, and infralabials and chin shields with a white center (Franco et al. 2017), while *T. almae* presents the gular region that is almost immaculate, with just a few scattered, small, brownish spots or blotches present; in *T. almae* the dorsal scales are heavily keeled (Franco and Ferreira 2002).

Taxonomy and conservation are different fields: the first is interested in describing biodiversity and the second in protecting it (Ely et al. 2020). However, to apply legal instruments to guide conservation decisions we must first identify the species and know their geographical distribution to be able to design effective protected areas. Thus, one important target of the Convention on Biological Diversity (CBD 2020) is to fill the Wallacean shortfall by gathering and sharing distribution data. This paper provides a newly reports a species of snake from the state of Piauí and also improves our knowledge of the distribution of an endemic species of the Caatinga, which is an ecoregion largely neglected in terms of its conservation (Guedes et al. 2014b).

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## Authors' Contributions

DBSB performed the literature review for occurrence data and wrote the first draft; MSCSL assisted DBSB

with the literature review and contributed writing the first draft; TBG identified the specimens, performed pholidosis, measurements, photographed the specimens, prepared figures, revised the draft, and prepared the first version of the manuscript; all authors revised the manuscript.

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